

What is claimed is:

1. An apparatus for recognizing a gray scale image, comprising:

5 inputting means for inputting a gray scale image;
and

 multi-code image binary-coding means for
converting the inputted gray scale image to a binary
image in which each pixel has a value representing
10 either a background area or a plotting area in the
gray scale image.

2. An apparatus for recognizing a color document
image, comprising:

15 gray scale image extracting means for extracting
a gray scale image from an inputted color document
image; and

 multi-code image binary-coding means for
converting the gray scale image to a binary image in
20 which each pixel has a value representing either a
background area or a plotting area in the gray scale
image.

3. An apparatus for recognizing a color document
25 image, comprising:

gray scale image extracting means, when an inputted document image is a color document image, for extracting a gray scale image from the color document image; and

5 multi-code image binary-coding means, when an inputted document image is a color document image, for converting a gray scale image extracted by the gray scale image extracting means to a binary image in which each pixel has a value representing either a background area or a plotting area in the gray scale image, or when an inputted document image is a gray scale image, for converting the gray scale image to a binary image in which each pixel has a value representing either a background area or a plotting area in the gray scale image.

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4. The apparatus according to claim 1, further comprising

20 binary image recognizing means for recognizing a binary image outputted by said multi-code image binary-coding means and electronically coding the binary image.

25 5. The apparatus according to claim 1, wherein said multi-code image binary-coding means includes

partial image binary-coding means for executing
a binary-coding process for each of the partial areas
5 of the gray scale image and extracting a partial
binary image, and

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13. The apparatus according to claim 11, wherein said partial area extracting means calculates an edge binary image representing an outline of a plotting stroke by the edge extracting process and extracting the one or more partial areas based on this edge binary image.

14. The apparatus according to claim 13, wherein said
partial area extracting means calculates the edge
binary image by executing a binary-coding process for
15 the edge strength image corresponding to the gray
scale image.

15. The apparatus according to claim 13, wherein said partial area extracting means calculates said edge binary image of which the edge outline is somewhat contracted by executing a binary-coding process for the edge strength image corresponding to a gray scale image to calculate a temporary edge binary image, shifting each edge pixel of the temporary edge binary image in the forward or backward direction of the edge


direction image to contract the outline formed by the edge pixels.

5 16. The apparatus according to claim 13, wherein said partial area extracting means calculates coupling elements of the edge element of the edge binary image and calculates each of the partial areas based on each of the coupling elements.

10 17. The apparatus according to claim 16, wherein said partial area extracting means calculates a circumscribed rectangle of each of the coupling elements as each of the partial areas.

15 18. The apparatus according to claim 16, wherein said partial area extracting means calculates an overlapping rectangle of a circumscribed rectangle of each of the coupling elements as each partial area.

20 19. The apparatus according to claim 13, wherein said partial area extracting means judges an extremely long outline from outlines composed of edge pixels in the edge binary image to be a ruled line, removes the extremely long outline and extracts the partial area
25 based on an edge binary image which is composed of




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scale image corresponding to the designated partial area.

31. The apparatus according to claim 30, wherein said
5 partial image binary-coding means changes a size of
the local area according to a width of a plotting area
contained in the partial area when calculating the
variable threshold.

32. The apparatus according to claim 30, wherein said
10 partial image binary-coding means changes a size of
the local area according to a size of the partial area
when calculating the variable threshold.

33. The apparatus according to claim 5, wherein said
15 partial image binary-coding means calculates a gray
scale partial image corresponding to a designated
partial area by interpolating a pixel value of the
gray scale image and executing a subpixel generating
20 process which increases a number of pixels of an
image, and extracts the partial binary image by
executing the binary-coding process for the gray scale
partial image.

25 34. The apparatus according to claim 33, wherein the

subpixel generating process includes a linear interpolation process for the pixel value.

35. The apparatus according to claim 33, wherein the
5 variable threshold is determined by calculating a
linear sum of mean values, standard deviation and
distribution of pixel values in a local area
containing a pixel to be binary-coded in the gray
scale image corresponding to the designated partial
10 area.

36. The apparatus according to claim 35, wherein said
partial image binary-coding means changes a size of
the local area according to a width of a plotting area
15 contained in the partial area when calculating the
variable threshold.

37. The apparatus according to claim 35, wherein said
partial image binary-coding means changes a size of
20 the local area according to a size of the partial area
when calculating the variable threshold.